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GRAPHICS AND ITS APPLICATION TO THE PROGRESS AND COST ANALYSES OF A HOUSE BUILDING CONSTRUCTION COMPANY.

by

Frank Lewis Leonard Wilson '08.

Huntington, West Virginia.

A

T H E S I S

submitted to the faculty of the

SCHOOL OF MINES AND METALLURGY OF THE UNIVERSITY OF MISSOURI

in partial fulfillment of the work required for the

D E G R E E O F

METALLURGICAL ENGINEER

Rolla, Mo.

1919

Approved by _____

TABLE OF CONTENTS.

By "Graphics",we mean the Illustrating of Ideas,Facts, or Data by Pictures, Linear Figures, Diagrams, or Symbolic Curves.

The word itself, is derived from the Greek word Graphein, meaning to write.

Technical Graduates are all familiar with the construction of the ordinary Graph where Cartesian co-ordinates are usually employed. Two lines or axes at right angles to each other are chosen, intersecting at a point called the origin.

The horizontal axis is called the axis of abscissae, the vertical axis the axis of ordinates.

Along the one, say the axis of abscissae, distances are taken from the origin corresponding to the values of one of the variables: at these points perpendiculars are erected and along these ordinates, distances are taken corresponding to the related values of the other variable. A line through these plotted points is called the Graph.

Graphs are usually plotted on co-ordinate paper ruled into squares. The plotted curves show the relations existing between the different sets of data which are called Variables.

Generally there are two variables, the Dependent one and the Independent one.

The independent variable is used as a standard or measure by which we interpret the facts we are considering.

True, there are more than two variables in a large number of cases, but we will nottake up the more complicated ones.

As the Use of Graphs has grown so rapidly and to such a large extent, the American Society of Mechanical Engineers decidedthat is was time to formulate some applicable principles for Elementary Graphic Presentation. Just recently, they asked fifteen of the societies of national scope to appoint one member of each society to form a Joint Committee with them, on Standards.

These men were well qualified for the task as they daily have extensive use for graphic presentation in their own work and are now studying different methods used in varios lines of work for presenting statistical and quantitative data in graphic form.

Permit me to give the names of this Committee and the Societies they represent:

Willard C. Brinton, Chairman, Amer. Soc. Mech. Engrs.
Leonard P. Akers, Secretary, Amer. Statistical Ass.

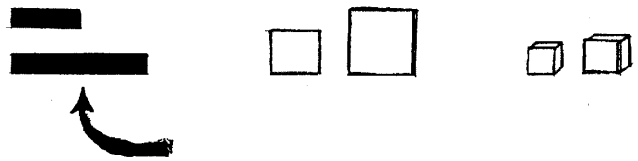
1. N.A.Carle----Amer. Inst. Elect. Engrs.
2. R.E.Chaddock-Amer. Ass. for Advancement of Science
3. F.A.Cleveland Amer. Acad. of Political & Social Scien.
4. H.E.Crampton--Amer. Genetic Ass.
5. W.S Gifford---Amer. Economic Ass.
6. J.A.Harris----Amer Society of Naturalists.
7. H.E.Hawkes----Amer. Mathematical Society.
8. J.A.Hill------U. S. Census Bureau.
9. R.H.Montgomery-Amer. Ass.of Public Accountants.
10. H.H.Norris-Soc. for Promotion of Engineering Education.
11. Alexander Smith-Amer. Chemical Society.
12. Judd Stewart--Amer Inst. of Mining Engineers.
13. H.D.Hubbard---U. S. Bureau of Standards.
14. Wendell M. Strong- Actuarial Soc. of Amer.
15. E. L. Thorndike--Amer. Psychological Ass.

I have given the names of this strong committee to show that when "Men of Such Caliber" are mobilized to take up the subject of Graphic Presentation, they realize the importance of the subject and can fore-see the extensive field it has for the Future.

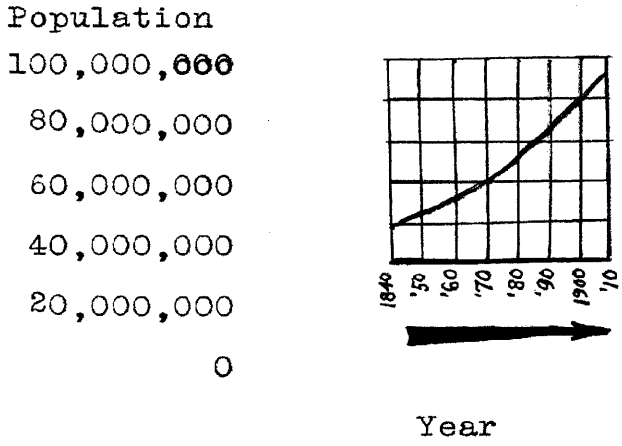
The following twenty-five rules are suggestions that this committee has submitted for consideration:

1. Avoid using ares or volumes when representing quantties. Represent rather by Linear Magnitudes.

Year.	Toms.
1900	270,588
1914	555,031



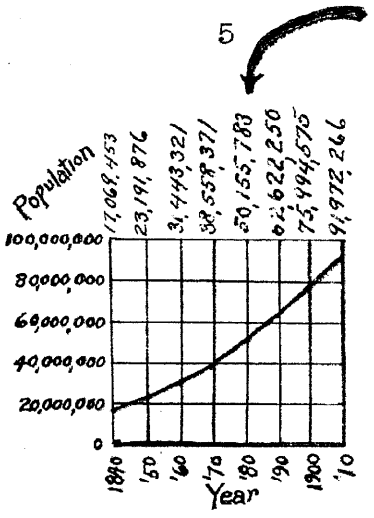
2. The general arrangement of a chart should be from left to right.



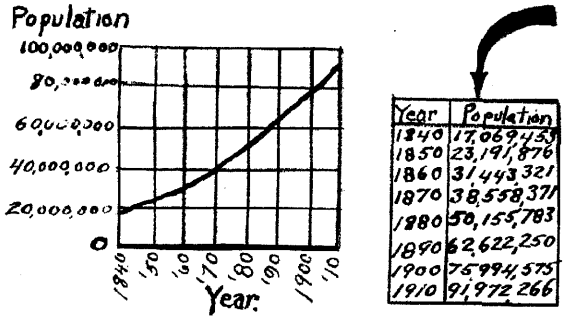
3. Figures for the horizontal scale should always be placed at the bottom of a chart. If needed, a scale may be placed at the top also.

4. Figures for the vertical scale should always be placed at the left of a chart. If needed, a scale may be placed at the right also.

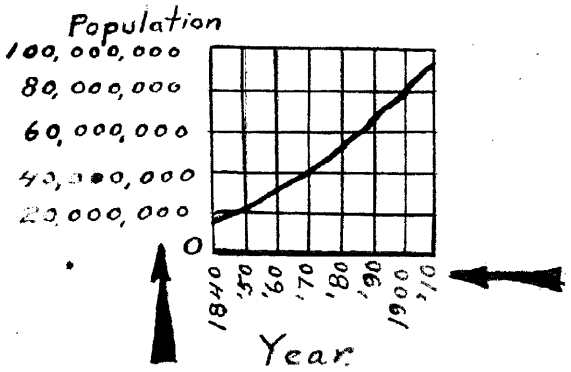
5. Whenever possible, include in the chart the numerical data from which the chart was made.



6. If numerical data are not included in the diagram it is desirable to give the data in tabular form accompanying the diagram.



7. All lettering and all figures on a diagram should be placed so as to be easily read from the base as the bottom, or from the right-hand edge of the diagram as the bottom.

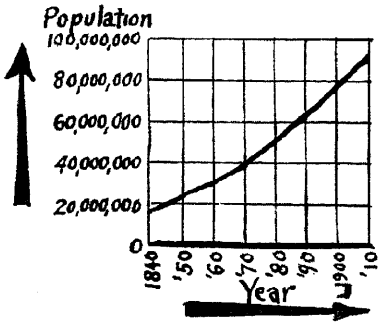


8. A column of figures relating to dates should be arranged with the earliest date at the top.

9. Separate columns of figures, with each column relating to a different date, should be arranged to show the column for the earliest date at the left.

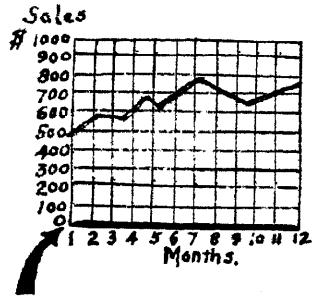
10. When charts are colored, the color green should be used to indicate features which are desirable or which are commended, and red for features which are undesirable or critized adversely.

11. For most charts, and for all curves, the independent variable should be shown in the horizontal direction.

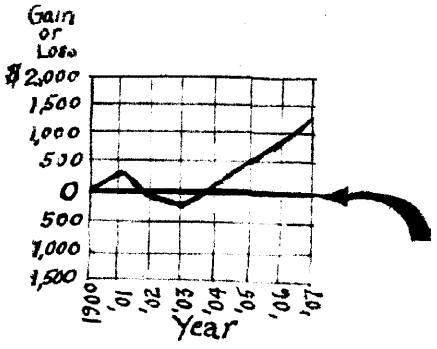


12. The horizontal scale for curves should usually read from left to right and the vertical scale from bottom to top.

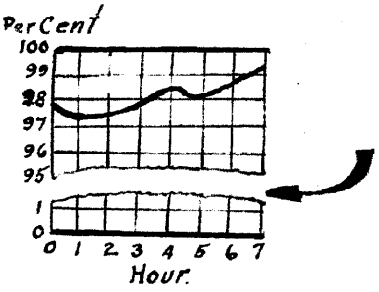
13. For a curve the vertical scale whenever practicable, should be so selected that the zero line will appear on the diagram.



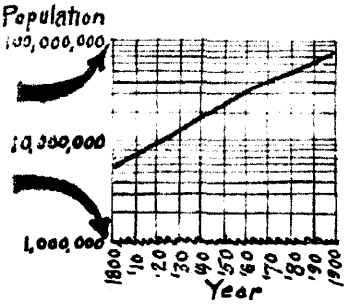
14. The Zero Lines of the scales for a curve should be sharply distinguished from the other coordinate lines.



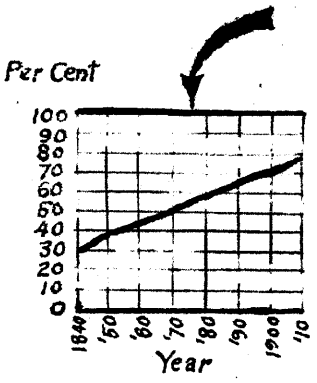
15. If the zero line of the vertical scale will not normally appear on the curve diagram, the zero line should be shown by the use of a horizontal break in the diagram, or else the bottom line should be slightly Wavy indicating that the field has been broken off and does not reach to zero.



16. When curves are drawn on logarithmic coordinates, the limiting lines should be at some powerof ten on the logarithmic scales.

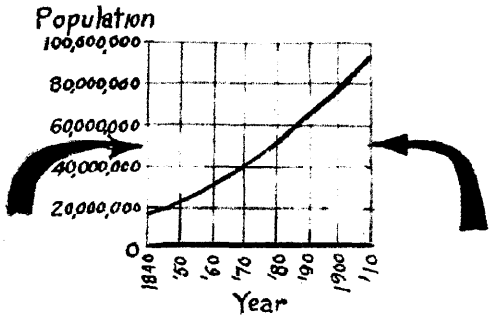


17. For curves having a scale representing percentages, it is usually desirable to emphasize in some distinctive way the 100 per cent line or other line used as a basis of comparison.

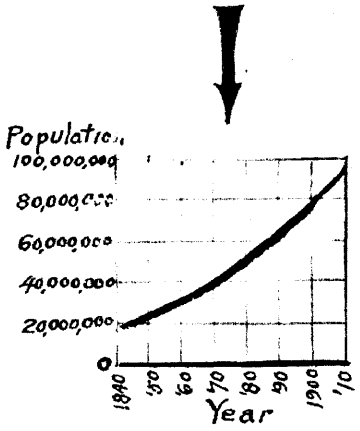


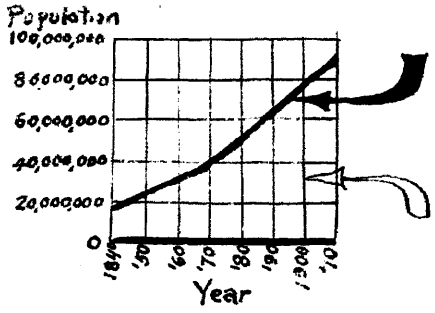
18. If the horizontal scale for a curve begins at zero the vertical line at zero(usually the left-hand edge of the field) should be a broad line.

19. When the scale of a diagram refers to dates, and the period represented is not a complete unit, it is better not to emphasize the first and last ordinates, since such a diagram does not represent the beginning or end of time.



20. It is advisable not to show any more coordinate lines than necessary to guide the eyes in reading the diagram





21. The Curve Lines of a diagram should be sharply distinguished from the ruling.

22. Whenever possible have a vertical line of the co-ordinate ruling for each point plotted on a curve so that the vertical lines may show the frequency of the data observations.

23. If there are not too many curves drawn in one field it is desirable to show at the top of the chart the figures representing the value of each point plotted in a curve.

24. When figures are given at the top of a chart for each point in a curve, have the figures added if possible to show totals(yearly) or other totals which may be useful in reading.

25. Make the title of a chart so complete and so clear that misinterpretation will be impossible.

These Rules and Diagrams were copied from the small pamphlet or report issued by the Committee.

The volume of comparative figures and general data of a scientific, technical and statistical nature is constantly increasing.

Pick up almost any magazine, newspaper, or text book, of a technical nature, of today and see the vast amount of data and statistical information they contain and we shall then see the growing need for Presentation in a Graphic Form so that we can get something like a fair idea of what has been presented.

In these later days, we have learned to talk in big figures, such as so many billions of dollars being raised for the Liberty Loans, the cost of the war running into billions, millions of soldiers, and so on in endless manner, and yet we are hopelessly lost trying to imagine what these staggering sums mean.

The human mind cannot conceive of millions. To most of us, even tens of thousands convey no concrete idea, except that of a numeral and four ciphers.

We are spending millions of dollars annually for collecting statistics and data.

How to present these enormous amounts of quantitative facts which have cost so much time, labor and money, demands a solution.

Though the data may be accurate and the facts real, and both very valuable, yet the mere statement of them to most of us is vague.

Ordinarily, facts do not speak for themselves, and even when they do, too many times are wrong conclusions drawn as a result, because it is so hard to present them in a clear and interesting manner.

How dry are Facts by themselves. Show them graphically and we are all interested immediately. Like small children, to whom pictures are Realities, we all understand pictures better than we do descriptions and figures.

We are not all as fortunate as the small group of men who seem able to get a clear mental picture of the significance and relation of groups of figures

As a rule the most of us require mental concentration to interpret even simple figures unless Graphs gives us a picture of them.

If presented graphically, then we can show them in their true proportion and thus get the correct interpretation.

It is surprising how many good points charted information brings outclearly which would probably have been overlooked otherwise.

Graphics are not only more convincing than figures or facts, but presents them with a great saving of time, "the most valuable thing in the world", and a clearness not obtainable in any other

way.

Like any other thing, Graphics have their limitations too, but they solve many of our difficult problems for us, and often times where no solution is shown, we will know where to look for it.

No other known method for presenting figures for analyses can compare with or permit such fine interpretation as the Curve.

How we study and try to fathom out its Peaks and Valleys to see if we can locate their causes and when located we should always record them for future use or for any one else who must make use of them in the future.

At Present, we are badly handicapped by not having standards of graphic presentation, by which we can prepare a chart and know that we are following good practice, but just as soon as simple and convenient ones are found and become generally known, then the universal use of graphic methods will be the result and we can then impartcomplex information so easily as to be understood by the average person.

We know that the principles of charting and

curve plotting are not complex and believe them simple enough to be taught school children.

The public schools of Newark and Trenton, New Jersy are teaching their grammar school pupils how to plot curves and make charts.

Geographies of today, are making good use of charts but resort too much to the Area methods which are not so well recommended as the Linear methods.

When the average citizen or business man learns to interpret charts and curves, just as every engineer, physician, statistician, biologist do, the use of graphics will be limitless.

We know however, that at present, most men dodge the simplest charts as though they involved what most of us like to shun,"Higher Mathematics".

Let us now see some of its applications.

In the graphical analyses of Stresses in Framed Structures, we study, by means of diagrams, the stability or equilibrium of structures and the relation between the external forces and the stresses created in the members of the frame.

The principle involved is that we may represent any force both as to direction and intensity by a straight line, by considering the direction of the line to be identical with that of the force and adjusting its length according to any arbitrary unit adopted for the forces under consideration.

By this means we can solve the stresses in framed structures with a wonderful degree of accuracy. True not absolutely correct but as nearly accurate as the practi cal design of any member in the structure can be.

When we consider the wonderful possibilities of Graphics in solving our problems, we are not surprised to learn of the extensive use made by some of the large business firms.

Day and Zimmerman, Consulting Engineers of Philadelphia, Pa., plot about 8,000 curves a month, mostly on a cumulative basis. They have also developed different methods of notching the cards so as to prevent replacement of the charted cards at a wrong position in the file.

Westinghouse Electric and Manufacturing Company of Pittsburgh, Pa., plot 4,000 monthly recording the

operations of its many departments. Complete records are kept, and these are used for comparison from year to year.

All Smelters and Ore Mills now have their "Flow Sheets" or graphic representation of their products through the plants.

When we try to follow the Ore through a mill from a description, it is certainly a task that very few would enjoy, but the flow sheet makes it very simple to follow up and to study.

Organization charts have not yet come into their own, but are being rapidly installed by the large firms. One reason for t his is that so few firms are properly organized, and it is impossible to chart them. This is often given as a cause of so much inefficiency.

Military organizations are so well planned that each man knows from whom to take orders but business proceeds too much on personal authority.

The large manufacturing plants now have charts showing the routing of the work through their many processes and departments.

Railroads are large users of the curve and make it a practice of plotting to show operating

records for the use of their executives.

The Great War recently ended, was graphically shown by Maps,and Pins, with different colored glass heads representing the different armies, were stuck at such locations as the armies were located and were moved to follow the advances made. These maps were studied daily by millions of people in all the big cities.

Foot Ball games can be nicely charted and give more concise information than mere words alone could.

Most of the modern dairy farms are now plotting their weekly chart for each cow, showing the amount of milk and butter fat per animal. Those falling below a certain average are sent to the butcher.

Having now seen the extensive use of graphics let us take up some of the methods used. We have already mentioned Maps. Perhaps the most used of the graphical methods is the plotting of Curves.

Horizontal Bars is considered a good method especially so because we are all familiar with "Bars".

Periodic Photographs of any kind of construction work are excellent.

The Steptoe Valley Smelting and Refining Company of Mc Gill, Nevada, with whom I was connected

for three years, during construction days, made it a practice of having photographs taken of each job once a week and these were carefully dated and pasted in a book, each job having a book of its own, thus giving a picture history of the completed job from its start.

Some firms are now using the Moving Picture Cameras for their Time and Motion Study. They place in the camera field with the worker, a clock with a large dial and a sweeping second hand, and thus secure an automatic and permanent record of the workers movements and the corresponding elapsed time.

The real purposes of graphics are to obtain Clearness, Effectiveness, ant the Saving of Time, especially so the latter, in the plotting of curves for use of Executives, whose "Time Value"is almost impossible to compute. Anything that we can do to save his time by having the necessary facts and data for his use available on which he can base his important decisions should be installed practically without regard to the cost of it.

At present, too many executives are compelled to decide quicklyon matters of great importance because they cannot obtain and analyze facts quickly enough.

No executive should ever be compelled to render an important decision, on "Opinion Alone", but should have the actual facts prepared beforehand by some Data Keeper for his continous use or emergencies. This saves his time and gives him the necessary information for a correct decision.

We see the necessity of this step when we consider that a single Yes or No decision of his may cost the corporation the loss(or may be the gain) in earnings greater than the executive's yearly salary.

The "Big Men" of today, at the heads of our corportions, are mostly , those who have gradually climbed the ladder step by step, working in almost every department, and growing and developing along with the business.

Our future executive will be of a different type, and may be called a Graphical Executive, as he will have keen powers for accurate analyses, for he will have to depend altogether for his decisions, on facts and data collected and arranged for his use, and will be graphically represented. His decisions will be quickly made and rightly too, because they will be based on actual facts.

I believe it would be money well spent for any business of good size, to have a record room, fire proof, in which to keep its records in, the facts and data

and all statistics pertaining to the business . These records could tell the complete history of the business in every detail if put in the proper graphic form.

It has been predicted that within ten years all corporation directors and executives will be able to read and interpret curves of all kinds and the few who can not,will be the exception instead of the rule.

"Application of Graphics to our Cost Analyses and Progress Reports."

The Diamond Construction Company are builders of Miners Houses,Stores,School Houses,and Churches for the Big Bituminous Coal Companies,which have Camps at various localities in West Virginia and Kentucky.

The Contracts for building, come in blocks of from two to fifty houses at a time. These houses are generally of four, five, or six rooms, though for the officials, of course,they are larger and of better grade.

These houses are classed from "A", the best to B, C, down to "D", the cheapest.

Semi-Monthly Progress Reports, made out on Report Sheets printed for the occasion, containing all the items or operations involved in the building of a house complete, on which the Foremen fill out opposite any item, the number of houses and per cent completion for such items as work has been done, are sent in to the main office by the Foremen on each job.

Rules for Distribution are sent to each Foreman, so he knows exactly under what head or item to include any work not appearing on the report sheet.

These rules have been gone over carefully to see that they cover everything, and when a contract is estimated, the Engineer uses the same items for making out his costs.

The Semi-Monthly Reports are made up from the first of the month to and including the fifteenth, and from the sixteenth to the end of the month.

Daily Time Reports are also sent in by each Foreman, on printed forms, giving the names of the men employed, rate of pay, hours worked, the total labor cost for the day and the proper distribution of this cost.

These daily time sheets are checked over to see that all figures involved are correct, then entered in the Pay Roll book, and at the end of the semi-monthly period, are arranged in order of their

dates and fastened together by staples to a summary sheet which is on top, and which contains the total costs of each individual item, and also the daily totals of distribution.

These separate totals are added individually and should check, if the work has been properly recorded. This gives us all the necessary data for working out our unit costs to date.

By combining, the Progress Report which shows the items on which work was done, the number of houses and per cent completion of the various items, and then the Semi-Monthly Labor Cost Analyses sheet which shows the total work done, total cost and unitcost to date of every item that any work has been done on, we get all our information.

These records are "Cumulative" till the job is completed, when we get the true unit cost of each item, if the distribution has been properly made.

We have been making out a Final Cost Sheet at the completion of a job which showed a comparison between the Estimated unit cost and the Actual unit cost for each item, recording the amount over or

under for the items and the net over or under for the the total cost of the job for its completion, compared to the estimated cost.

In order to preserve all this data, which is no small task when you consider that we may have from ten to twenty Contracts, split up into from one to four jobs each, going at one time, we have designed a Summary Sheet for the Progress and Cost Analyses, twenty inches by twenty-eight, as per sample , on which every thing is entered pertaining to the job.

This sheet speaks for itself and is almost self explanatory, though will give a few words of explanation which may simply matters somewhat.

It is divided into three sections:
Section one or top section, is called the Progress section, where we plot the progress of the work as shown by the Semi-Monthly Progress Reports.

Suppose we have ten houses in job number one of our contract. In the top almost square blocks we write the numbers from one up to ten each for a house. Under house number one we write in the estimated unit costs of each item , in red ink.

Then as more houses are completed for the various items, we block inthe space opposite that item for the number of houses completed, by means

of a blank rubber stamp which almost fills up the space, always reserving the last one every time (which is not blocked in), for entering the date of work done at that period and the unit costs up to that date. When the next report comes in this same operation is carried on, in like manner to its final completion for the whole job. The last block always shows the date of completion for the item and its true unit cost at its finish.

The Middle Section or section two, contains all the Estimated Data for the contract.

Before the contract is taken, our Engineer goes over very thoroughly the Plans and Specifications of the houses and draws up Bills of Materials, showing the quantities necessary not only for the lumber, hardware, brick work, plumbing, but everything complete and then prices them. After the cost of Materials is figured and totaled, then the Labor Costs for all items are figured and we now have the estimated cost of the house, which price is submitted.

In section two then we record this data, showing the building quantity,for one house, the total

quantity for the whole job, and total price for each item and what per cent of the total cost, each item represents, which we make use of in section three to plot our Graph.

When the job is reported one hundred per cent completed, we then have after recording all the data, the Estimated Unit Costs in the first Column, the Actual Unit Cost in the last column of every item, and can see the comparison between them, which helps in our next estimating for fixing prices.

Under normal conditions, the Actual and the Estimated Costs would check generally within one per cent or less but the past four and a half War Years have upset prices and wages, so that closer watching and pricing was necessary and even then sometimes the comparative costs would vary a great deal and we would find out that not enough allowances were made for advances, especially when a job had been held up for material or labor and thus delayed for some time.

After a house has been estimated, a certain amount is added for overhead expense and then a certain per cent for profit.

We will now take up section three or lower section, where we plot our graph, showing the relations between the cost of the job to the per cent of completion.

We use the vertical axis for our per cent axis or independent variable, and the horizontal axis for the cost or dependent variable. True this does not conform to the rules laid down at the begining but we did it for good reasons.

We know that if a job costs $10,000 to complete, when all the items are 25% finished, theoretically, the cost should show ¼ of the cost or $2,500.

Now when we figure out at the end of the month, as we plot only once a month, the percentage of completion from the progress report and from our table showing cost percentage in section two, and find that at 25% completion, our cost is $3,500, we know that we are $1,000 over our Estimate at that point and our graph would run from zero to the second red line to the right of the percentage line opposite the 25% mark.

Each blue line represents one hundred dollars either over or under the estimated cost, depending on which side of the percentage line it is located.

If on the left side of the percentage line it is under the estimated price, on the right side it is over the estimated price. Each red line represe ents five hundred dollars.

The graph is carried on up the percentage line till it reaches the top or one hundred per cent line at its completion for the job.

With the graph plotted, we can now refer to our progress report and find out on just what items our costs were over and what under the estimate, and then try to locate the causes for the variances.

Each time we extend our graph, we put down to the left of that point in the first division, the date and total cost to that date, and at the right we record the amount of material delivered and cost of same.

If the actual costs coincided with the estimated at all its percentages of completion, the two graphs would naturally coincide too and followtogether straight up the percentage line.

In the upper right hand section of the sheet we record the rate of pay for the different classes of labor.

In the lower right hand section of the sheet we plot a composite of the whole job or contract, by combining the two, three or four jobs the contract may contain, and this gives us the net total gain or loss for that contract.

We now have a complete history of our contract, in all its details from its beginning to its completion and some valuable figures for future estimating.

Finis.

DIAMOND CONSTRUCTION COMPANY
HUNTINGTON, WEST VIRGINIA

DAILY REPORT OF TIME

CONTRACT NO._____

JOB NO._____

P. O._____ 191____

FORM 9 30M 11-17 6954 PARAGON PRINT

	NAME	HOURS	RATE	AMOUNT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
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12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
Total				

Condition of Weather

Sub—Contract Labor— Foundations Men

Chimneys Men

Lathing Men

Plastering Men

Plumbing Men

Painting Men

Wiring Men

Remarks:

Foreman.

DISTRIBUTION	AMOUNT
Excavation	
Foundation Piers or Posts	
Hauling Sand and Gravel	
Concrete Form Erection	
Concrete Placed without F'ms	
Concrete Placed in Forms	
Stone Quarrying	
Stone Hauling	
Stone Laying	
Brick Hauling	
Brick Laying	
Framing	
Storm Siding	
Siding	
Sheathing	
Roofing	
Ceiling	
Lathing	
Plastering	
Sub-Flooring	
Flooring	
Openings	
Stairs	
Other Inside Work	
Chimneys	
Fire Places	
Plumbing	
Wiring	
Outside Painting	
Inside Painting	
Cornice	
Out Buildings	
Timber Erection	
Handling Material	
Total Today	
Previous Total	
Charged to Date	

DIAMOND CONSTRUCTION COMPANY
HUNTINGTON. WEST VA.

SEMI-MONTHLY PROGRESS REPORT

Contract No.....

Job No.....

R. H. HAMILL, General Manager,
Huntington, West Va.

.....191..

DEAR SIR:

The following progress has been made to-date on the above Job: The entire job consists of

....Room Houses, Plan No.....
No. of Houses we are to build on this Job No. Rooms in each House

FORM 1 2M 10-18 11247

ITEM	COMPLETED		ITEM	COMPLETED	
	Number	%		Number	%
Excavation			Flooring		
Foundation			Openings		
Brick Work			Stairs		
Stone Work			Other Inside Work		
Concrete			Chimneys		
Framing			Fireplaces		
Siding			Plumbing		
Storm Siding			Wiring		
Sheathing			Outside Painting		
Roofing			Inside Painting		
Ceiling			Cornice		
Lathing			Outbuildings		
Plastering			Timber Erection		
Sub Flooring			Handling Material		

REMARKS:.....

.....

.....

.....

..... Number of Single Houses Occupied.....

Very truly yours,

.....

Superintendent.
Foreman.

DIAMOND CONSTRUCTION COMPANY

HUNTINGTON, WEST VA.

SEMI-MONTHLY LABOR DISTRIBUTION

CONTRACT No. .....

JOB No. .....

Form 22 2M 1-19 12650 PARAGON PTG. & PUB. CO., HUNTINGTON, W. VA.

DATE															TOTAL	BROT. FOR-WARD	TOTAL TO
Excavation																	
Piers																	
Hauling Sand and Gravel																	
Concrete Form Erection																	
Concrete																	
Stone Quarrying																	
Stone Hauling																	
Stone Laying																	
Brick Hauling																	
Brick Laying																	
Framing																	
Sub Flooring																	
Sheathing																	
Storm Siding																	
Siding																	
Flooring																	
Ceiling																	
Lathing																	
Plastering																	
Cornice																	
Other Outside work																	
Openings																	
Stairs																	
Other Inside work																	
Roofing																	
Chimneys																	
Fire Places																	
Outside Painting																	
Inside Painting																	
Wiring																	
Plumbing																	
Unloading Material																	
Hauling																	
Out Buildings																	

DIAMOND CONSTRUCTION COMPANY

HUNTINGTON, WEST VA.

SEMI-MONTHLY LABOR COST ANALYSIS

CONTRACT No. .....

JOB No. .....

PLAN No. .....

SUPERINTENDENT .....

FOREMAN .....

.... ROOM HOUSES

Form 2 2M 1-19 12649 PARAGON PTG. & PUB. CO., HUNTINGTON, W. VA.

ITEM	UNIT BASIS	TOTAL TO			PERIOD ..... TO			UNIT	
		Quantity	Amount	Unit Cost	Quantity	Amount	Unit Cost	Reduction	Increase
Excavation	Cu. Yd.								
Piers	L. Ft.								
Haul'g Sand & Gravel	Cu. Yd.								
Con. Form Erection	Sq. Ft.								
Concrete	Cu. Yd.								
Stone Quarrying	Cu. Yd.								
Stone Hauling	Cu. Yd.								
Stone Laying	Cu. Yd.								
Brick Hauling	Per M.								
Brick Laying	Per M.								
Framing	M. Ft.								
Sub Flooring	M. Ft.								
Sheathing	M. Ft.								
Storm Siding	M. Ft.								
Siding	M. Ft.								
Flooring	M. Ft.								
Ceiling	M. Ft.								
Lathing	Per M.								
Plastering	Sq. Yd.								
Cornice	Bldg.								
Other Outside work	Bldg.								
Openings	Each								
Stairs	Bldg.								
Other Inside work	Bldg.								
Roofing	Per Sq.								
Chimneys	Bldg.								
Fire Places	Each								
Outside Painting	Sq. Yd.								
Inside Painting	Sq. Yd.								
Wiring	Per Outlet								
Plumbing	Bldg.								
Unloading Material	Bldg.								
Hauling	Bldg.								
Out Buildings	Each								
		TOTALS							

DIAMOND CONSTRUCTION COMPANY

HUNTINGTON, WEST VA.

FINAL LABOR COST ANALYSIS

CONTRACT NO. _____

JOB NO. _____

PLAN NO. _____

STARTED _____ COMPLETED _____ SUPERINTENDENT _____

FOREMAN _____ RATE _____ AVG. NUMBER OF TEAMS _____ AVG. HOURLY RATE _____

AVG. MEN EMPLOYED _____ MAX. HOURLY RATE _____ MIN. HOURLY RATE _____ AVG. HOURLY RATE _____

Form 3 1M 9-17 6262

ITEM	UNIT BASIS	QUANTITY	ESTIMATED COST		ACTUAL COST		UNDER ESTIMATE		OVER ESTIMATE		REMARKS
			JOB	UNIT	JOB	UNIT	JOB	UNIT	JOB	UNIT	
Excavation	Cu Yd										
Fdtn P&P	Each										
Con Fm Frec	Cu Yd										
'pl W'Out Fm	"										
'pl in Forms	%										
Brk Hauling											
Brick Laying											
Framing	M. Ft.										
Storm Siding	M. Ft.										
Siding	M. Ft.										
Sheathing	M. Ft.										
Misc Lumber	M. Ft.										
Roofing	Per Sq										
Ceiling	M. Ft.										
Lathing	Per M										
Plastering	Sq Yd										
Sub-Flooring	M. Ft.										
Flooring	M. Ft.										
Openings	Each										
Stairs	Bldg.										
Other IS Wrk	"										
Chimneys	L. Ft.										
Flues	L. Ft.										
Fire Places	Each										
Wiring	Bldg										
OS Painting	Sq Yo										
IS Painting	"										
Cornice	Bldg										
Outbldgs	"										
Bdl Material	"										
		TOTALS,									

Report of Frank Lewis Leonard Wilson,

on

Positions held, kind of work done, length of service, and list of Companies worked for, since leaving school.

Left Rolla, Missouri, June 6, 1907.

1. June 13, 1907 to June 1, 1910.

At Mc.Gill, Nevada,

With The Steptoe Valley Smelting & Refining Co.

June 13,1907 to June 1,1908.-------- Construction Engineer.

June 1,1908 to Feb.1,1909.--------Assayer.

Feb.1,1909 to March 1,1909.--------Copper Chemist.

March1,1909 to June 1,1909.--------Slag Analyst.

June 1, 1909 to March 1,1910.---- Control Chemist.

March 1, 1910 to June 1,1910.----Act. Chief Chemist

(Had 11 Chemists under me).

2. June 1, 1910 to June 1, 1916.

At Omaha, Nebraska,

With the Omaha and Grant Smelter, of the American Smelting and Refining Company. Largest Lead Refinery in the World.

June 1, 1910 to August 1, 1910.-----General Chemist.

August 1, 1910 to Jan. 1,1916. ---- Chief Chemist.

Did all the electrolytic and control work on Copper Mattes, Babbitts, Bismuth- Lead- Copper-Gold-and Silver Bullion, Nickel Mattes, Blue Vitriol, Zinc, Arsenic,

Fumes, in fact almost everything in the metal line. I doubt if there is another smelter in the country that gets the variety that the Omaha Smelter gets.

Jan. 1, 1916 to June 1, 1916.---------Asst. Supt. of the Zinc Oxide Department and of Experimental Work.

3. June 1, 1916 to July 1, 1917.

At Omaha, Nebraska,

With H. Eisele, Alloy Maker and Gold Refiner. Did gold, silver and platinum refining for the Dentists, also the Sweeps. Made gold plates and solders for Dental Crowns, also silver solders and Plates, Woods Metal, besides Assaying and general chemical analyses.

4. July 1, 1917 to Sept. 1,1917.

At Lake View, Iowa,

On a Farm doing " Patriotic Farm Labor" fora cousin.

5. Sept.,15, 1917 to Nov., 15,1917

June 15, 1918 to Sept., 1, 1918

At Pontiac, Michigan.

REPORT. #3. F.L.L.W.

With Michigan Refining Works.
As Metallurgist, doing almost the same work as at H. Eisele, of Omaha, Nebraska, with additional refining of Amalgams and making of a dozen different silver alloys for the Dentists, also gold wires of all gauges and clasp metal.

6. March, 1918 to June, 1918.

At Detroit, Michigan,
With the Chalmers Automobile Company.
As Chemist, analyzing irons, steels, bronzes, brasses, babbitts, gasoline, and paints.

7. October 22, 1918 to Present Date.

At Huntington, West Virginia.
With the Diamond Construction Company.
Temporary Position, as Cost Accountant.

8. Dont know where?